Fundamental Concepts on the use of a Basic Dimension: Positional Tolerancing (GD&T)

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American National Standard

ANSI/ASME Y 14.5M - 1994
Dimensioning and Tolerancing

revision of

ANSI Y 14.5M - 1982
Both are in current use

Geometric Dimensioning & Tolerancing

Basic Dimensions

Positional Tolerancing &

Tolerance Zones they locate

Basic Dimensions

- Have No Tolerance
- Locate Tolerance Zones

Basic Dimensions

A dimension that is considered theoretically perfect.

Used to describe the theoretically exact size, profile, orientation, or location of a feature or datum target.

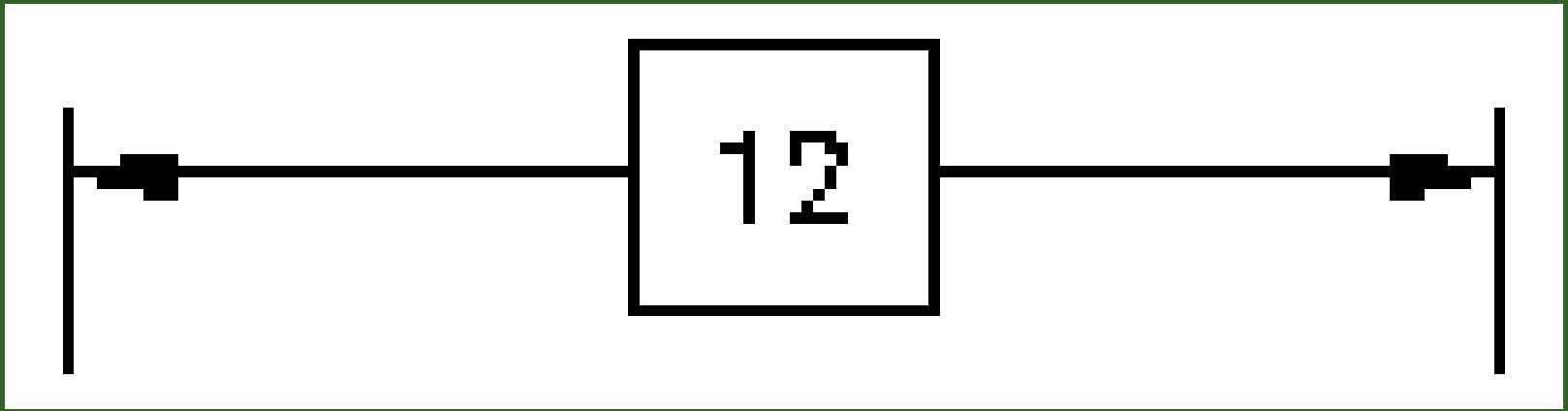
Basic Dimensions verses Conventional Dimensioning

- No plus and minus next to the dimension
- Placed in a rectangle

Basic Dimensions verses Conventional Dimensioning

- Identified by general note
  - Untoleranced dimensions locating true position are basic
- Locates associated tolerance zone

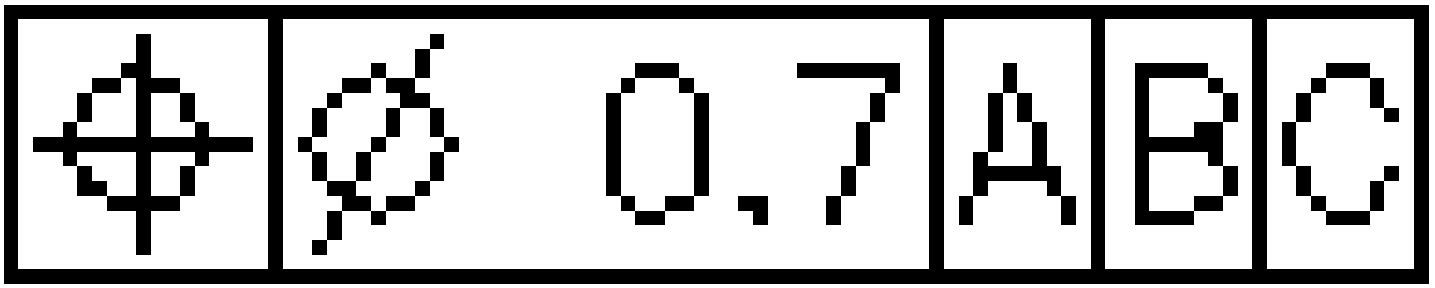
Basic Dimension



Describes a theoretically exact location

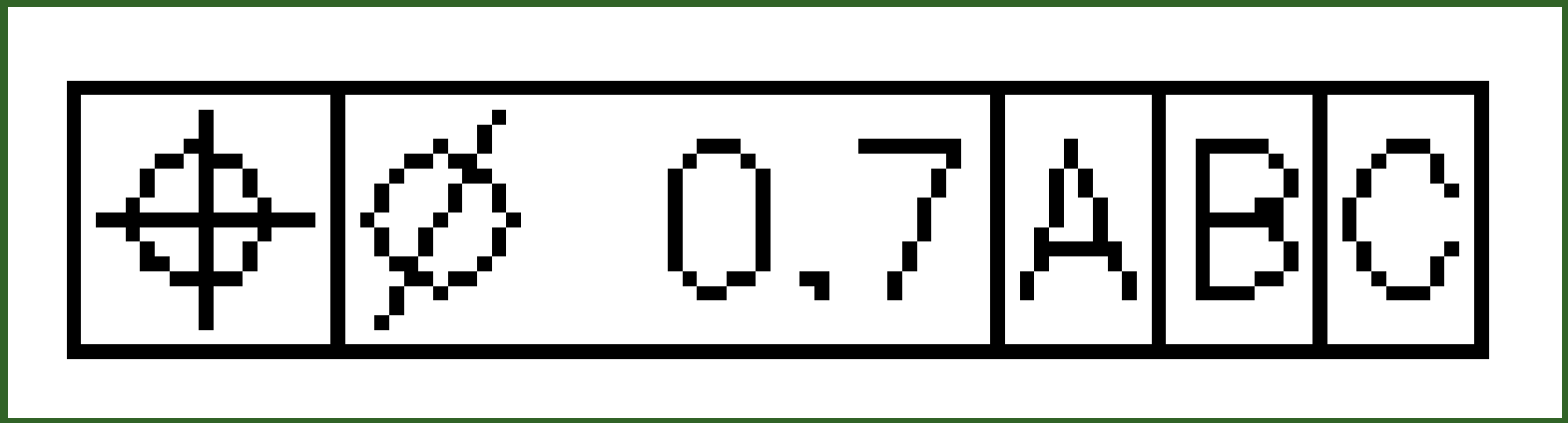
Where the associated tolerance zone is located

Feature Control Frame Tolerance Zone



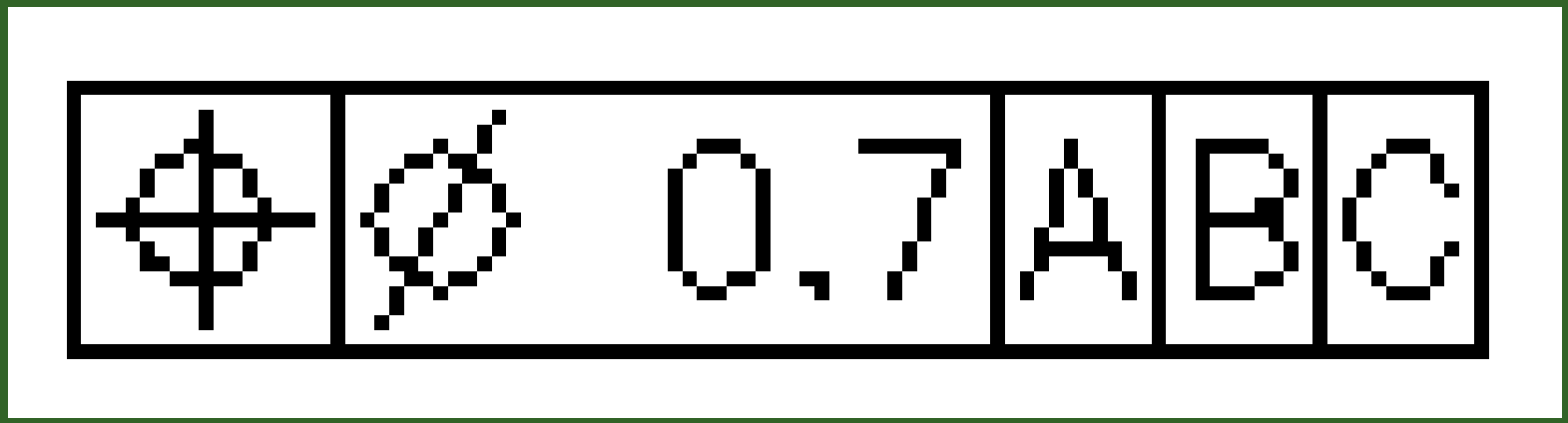
The associated tolerance zone is found in the feature control frame

Feature Control Frame



- True Position
- Zone Descriptor
- Tolerance
- Datums

Feature Control Frame



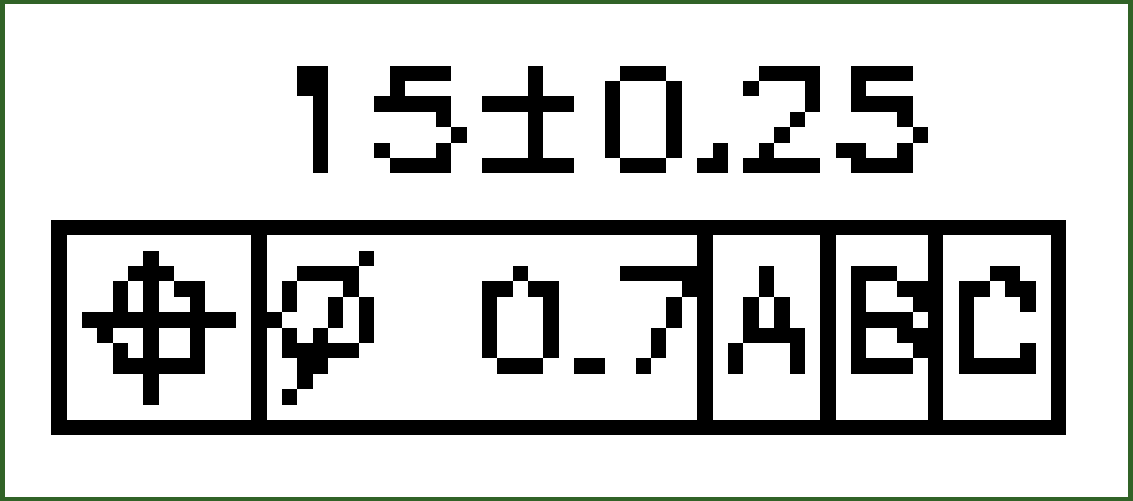
Axis of feature must remain in zone

0.7mm is total width of zone

Not a plus & minus tolerance

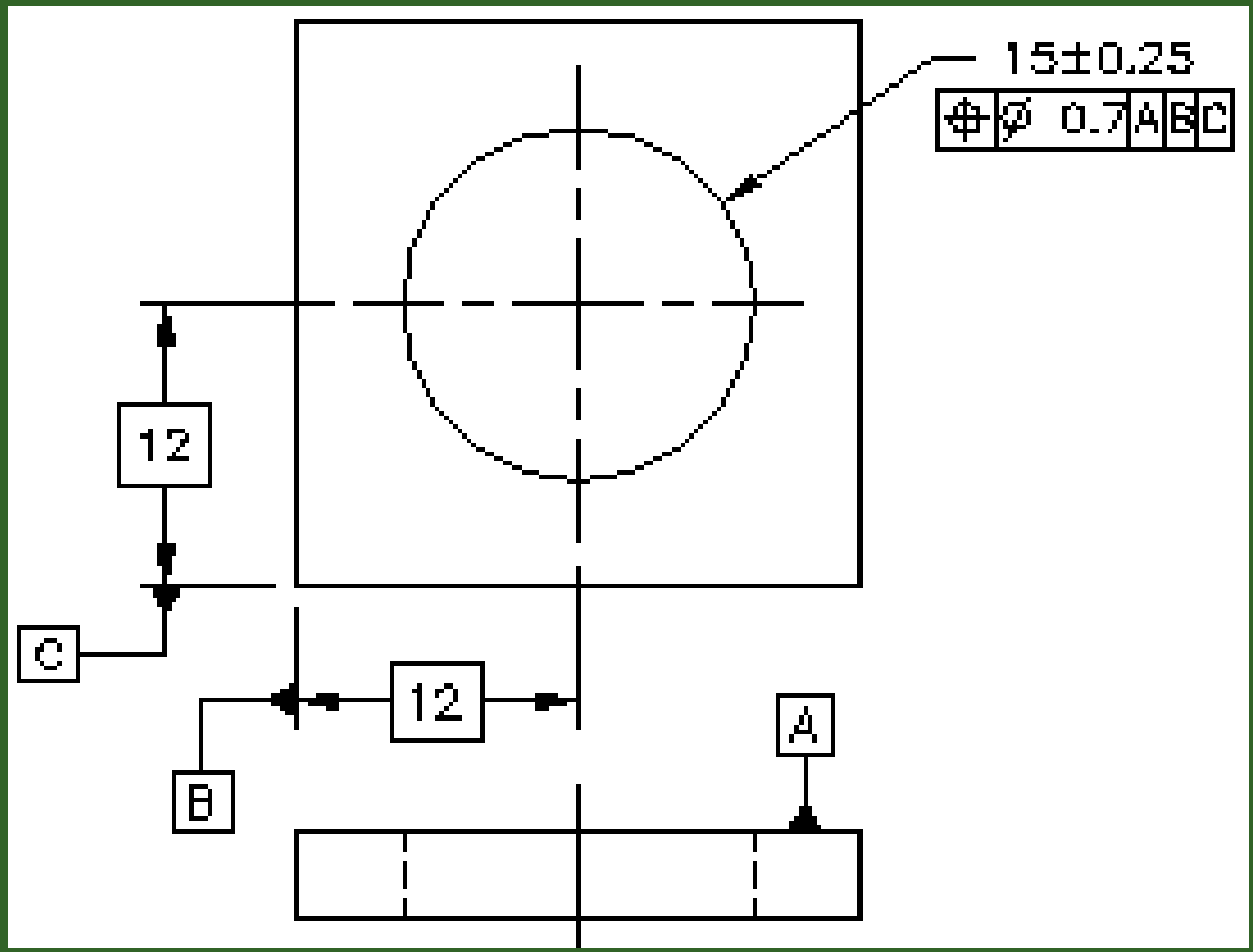
Zone is located at basic

Feature Control Frame

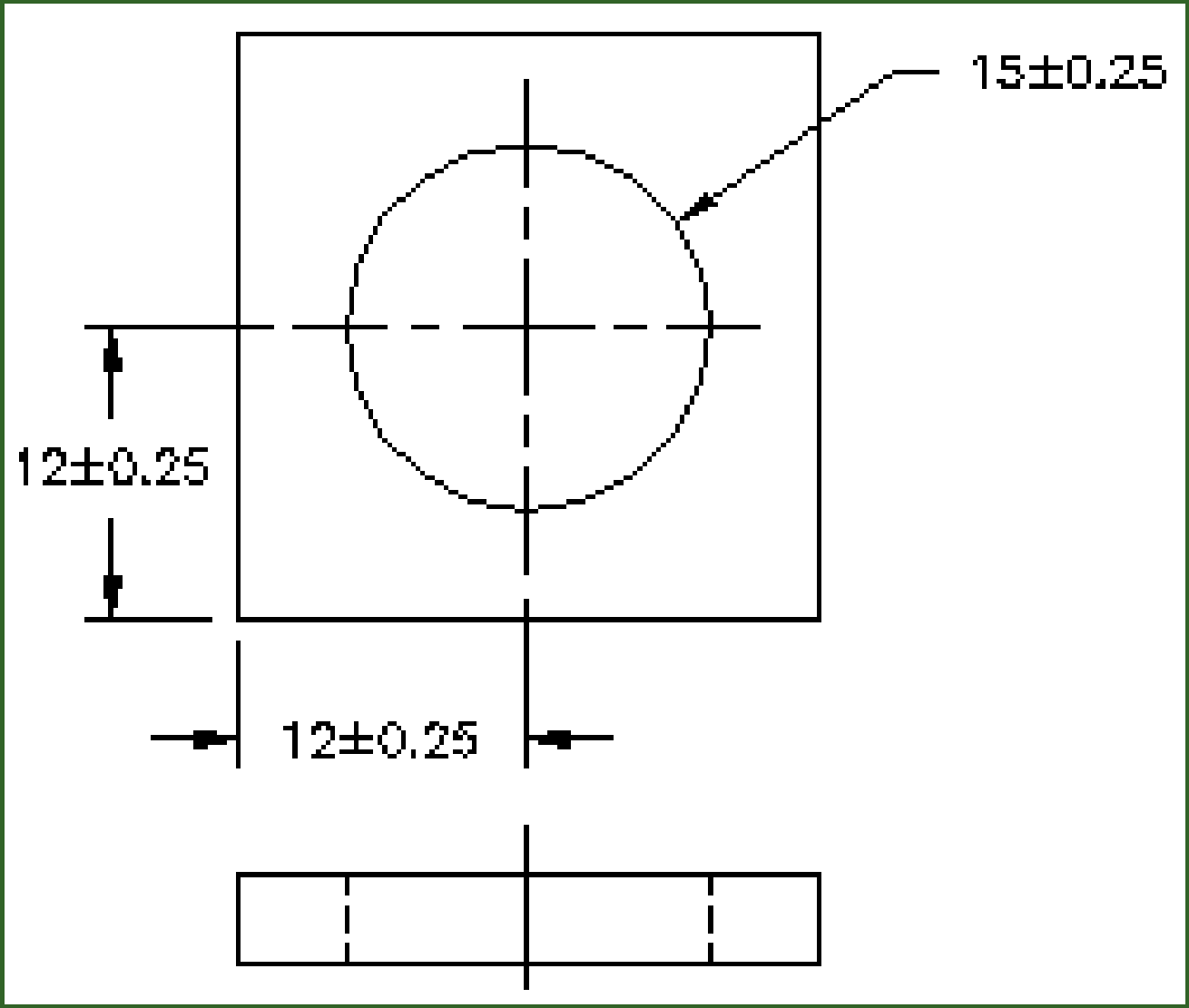


The feature control frame is located under the size dimension

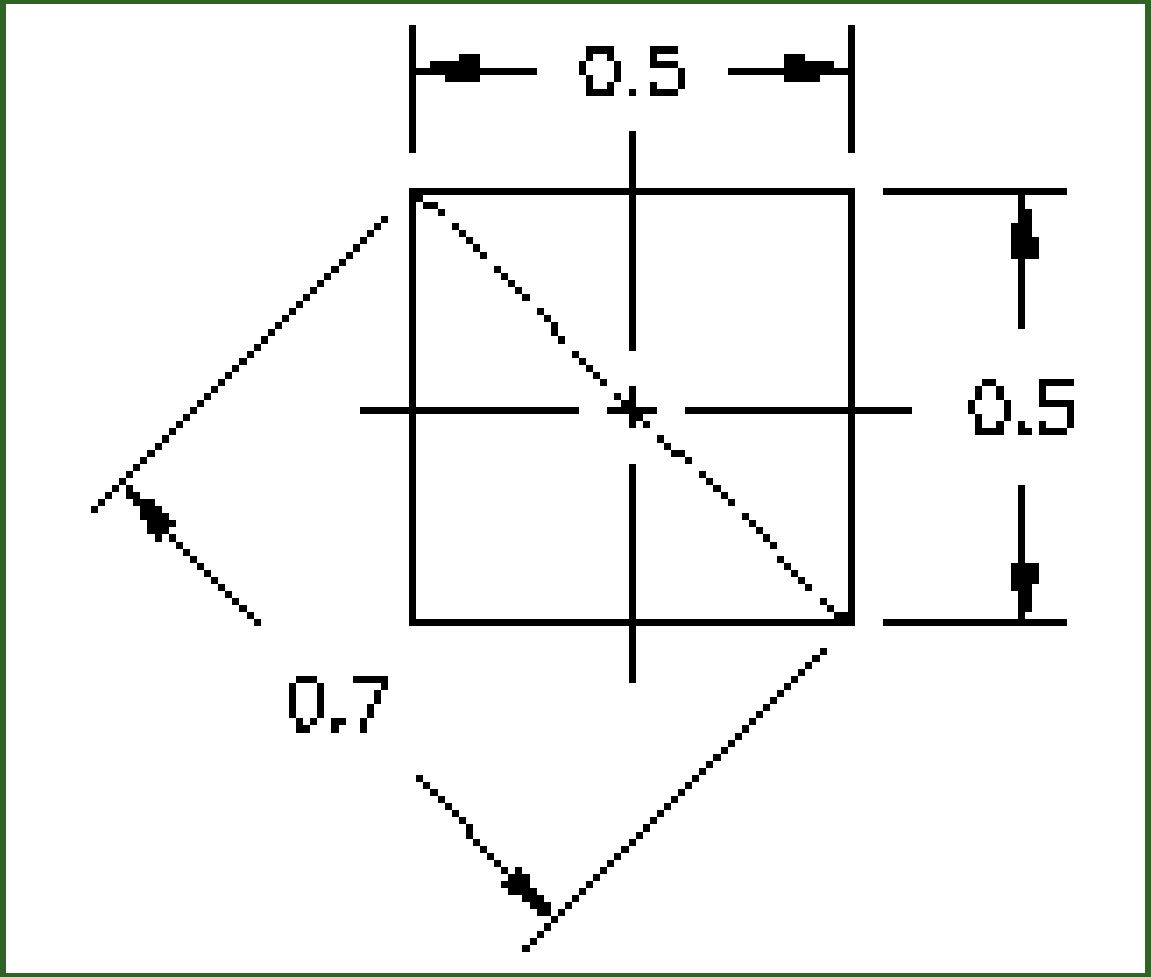
Positional Tolerance



Conventional Tolerance

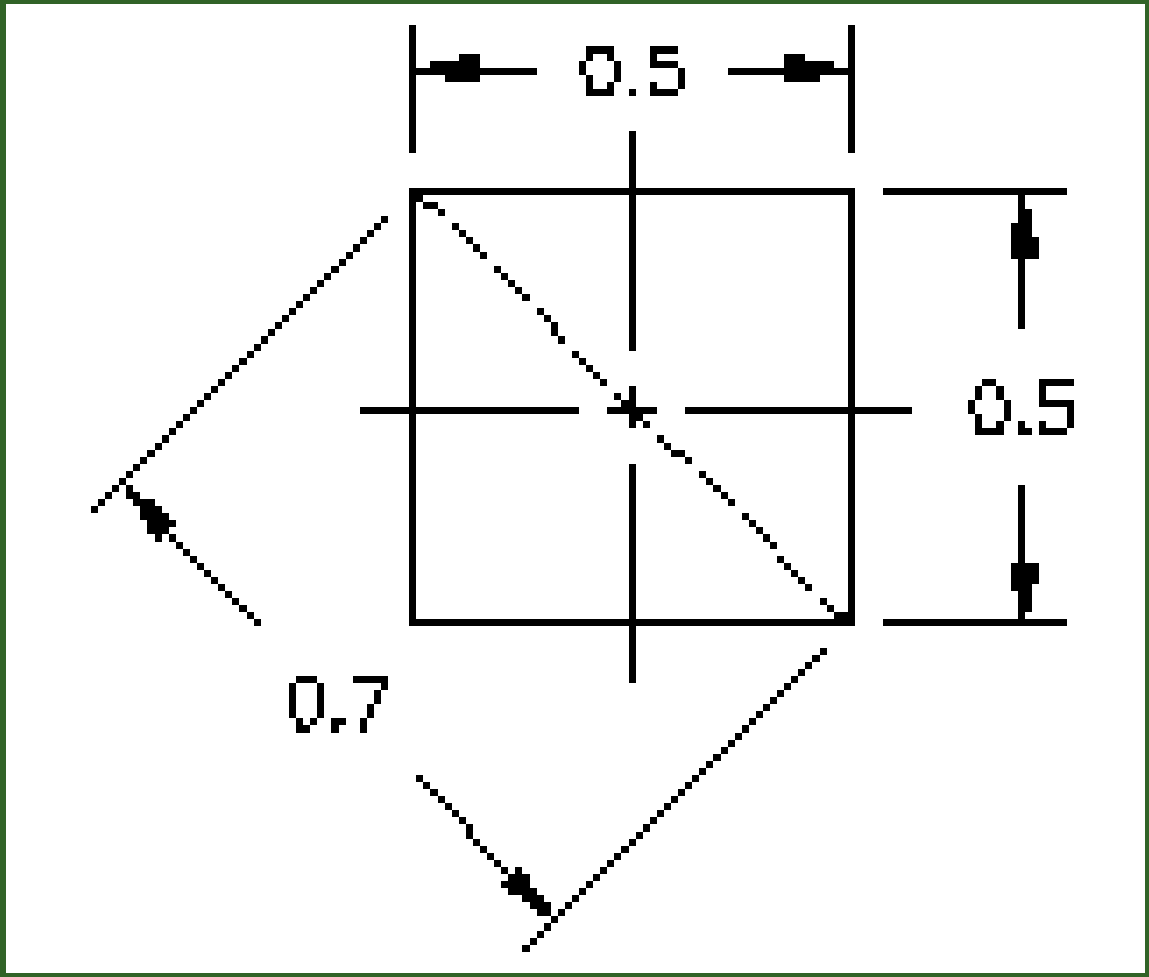


Conventional Tolerance



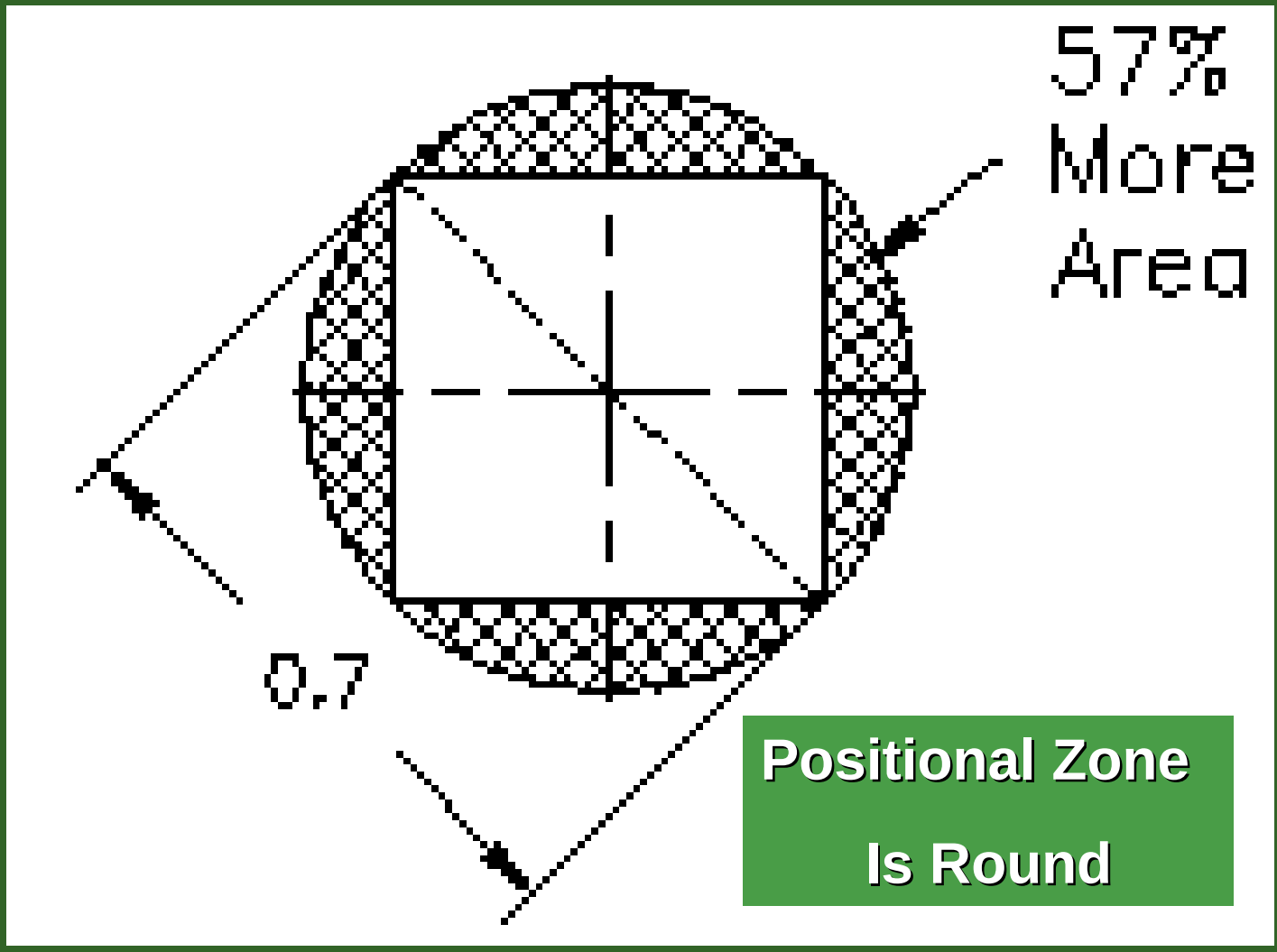
Shape of the zone is square

Conventional Tolerance



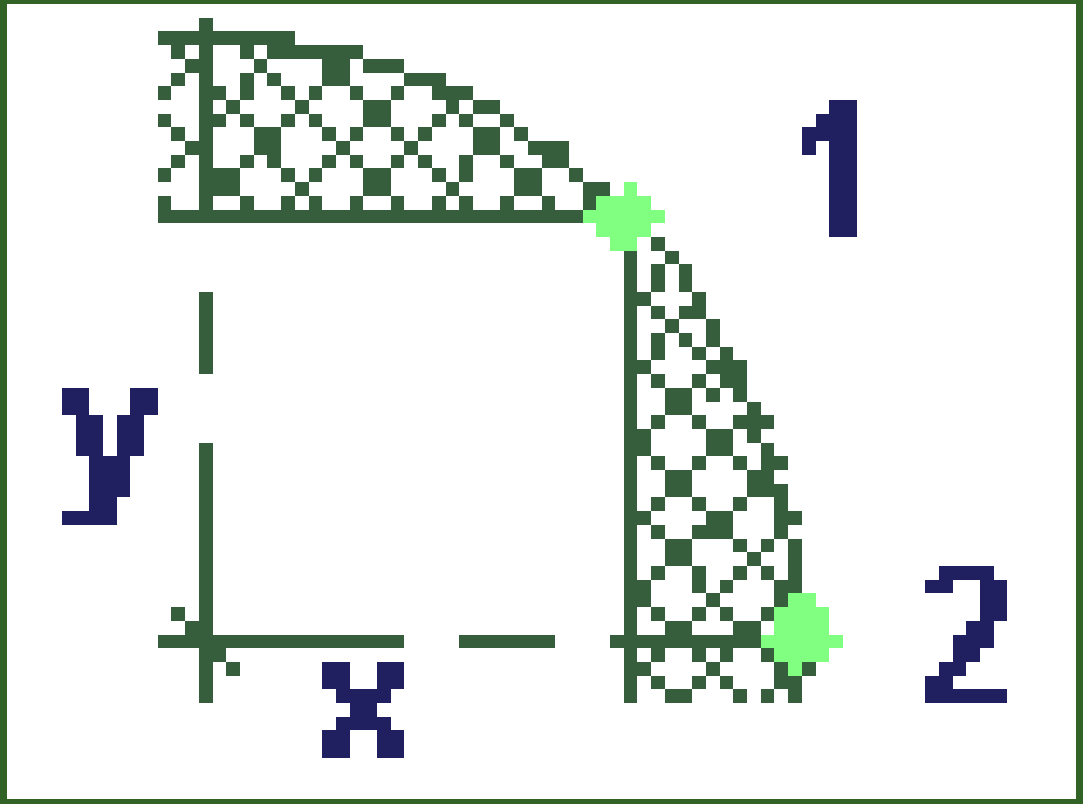
Axis of feature must remain within zone

Positional Tolerance Circumscribed about Conventional Tolerance



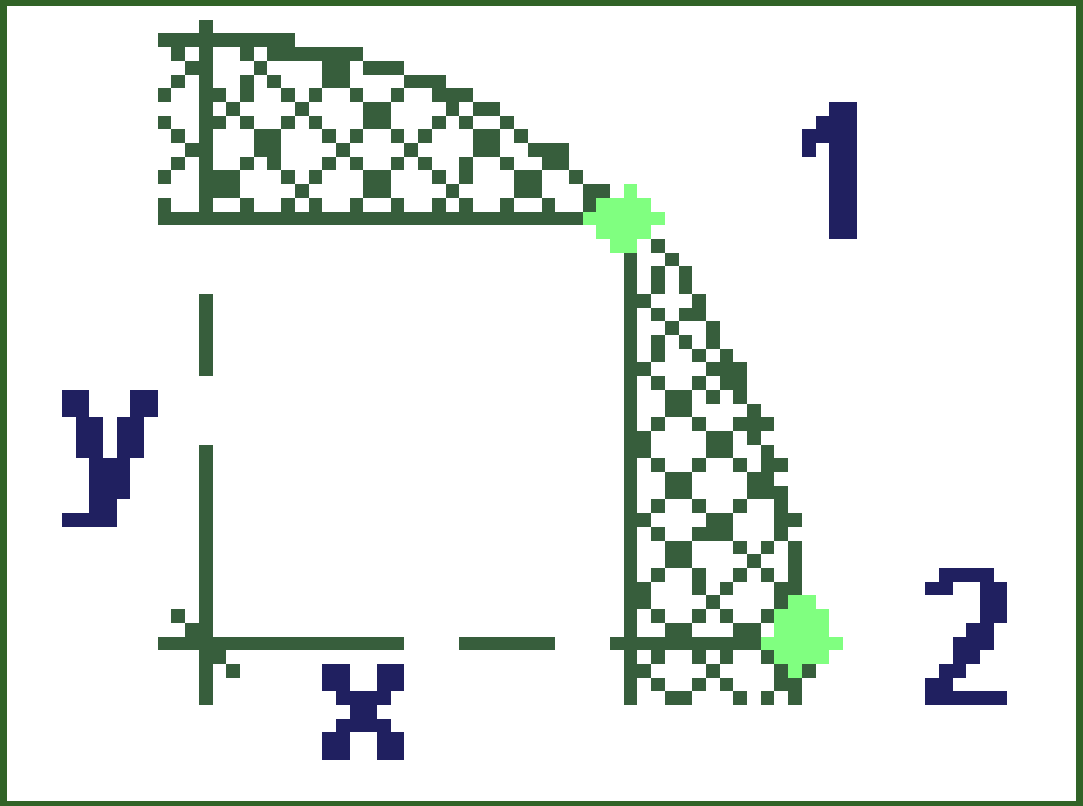
1 --- Max deviation in x and y

2 --- Max deviation in x
No deviation in y



Both locations will allow parts to be bolted together.

57% more area with positional tolerance

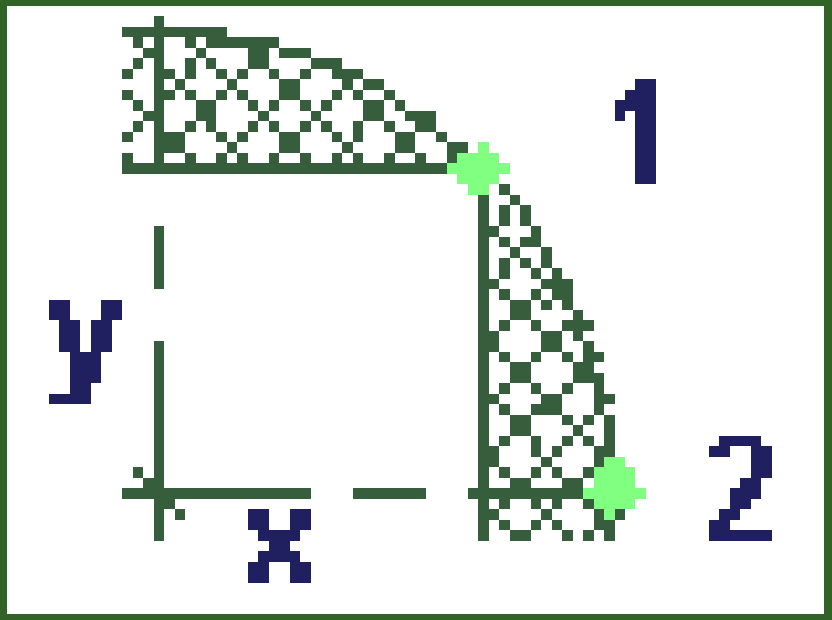


Both locations at zone boundary 0.7mm

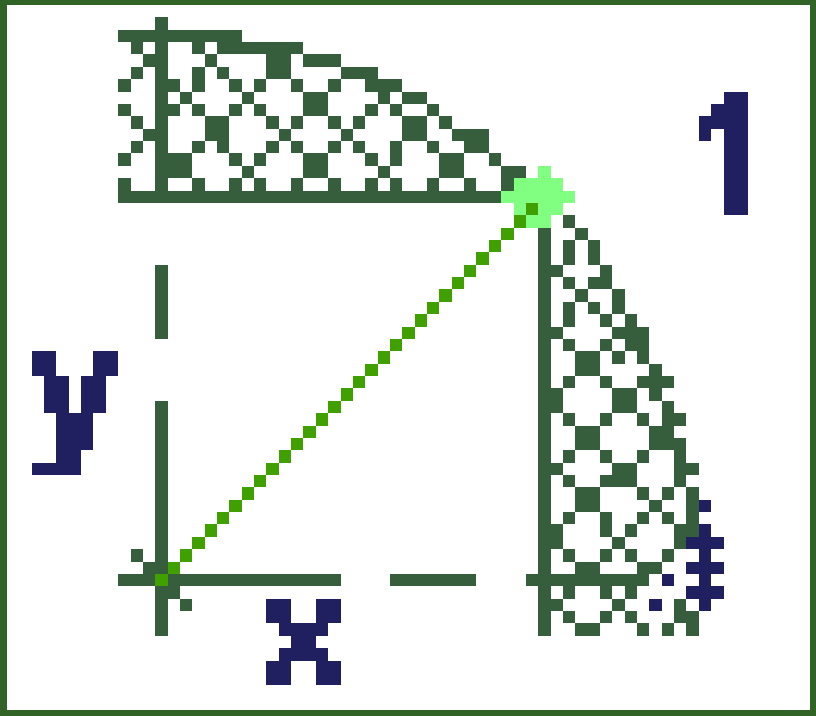
Point 1 x 0.25mm y 0.25mm

Point 2 x 0.35mm y 0.00mm

Formula $2\sqrt{x^2 + y^2}$



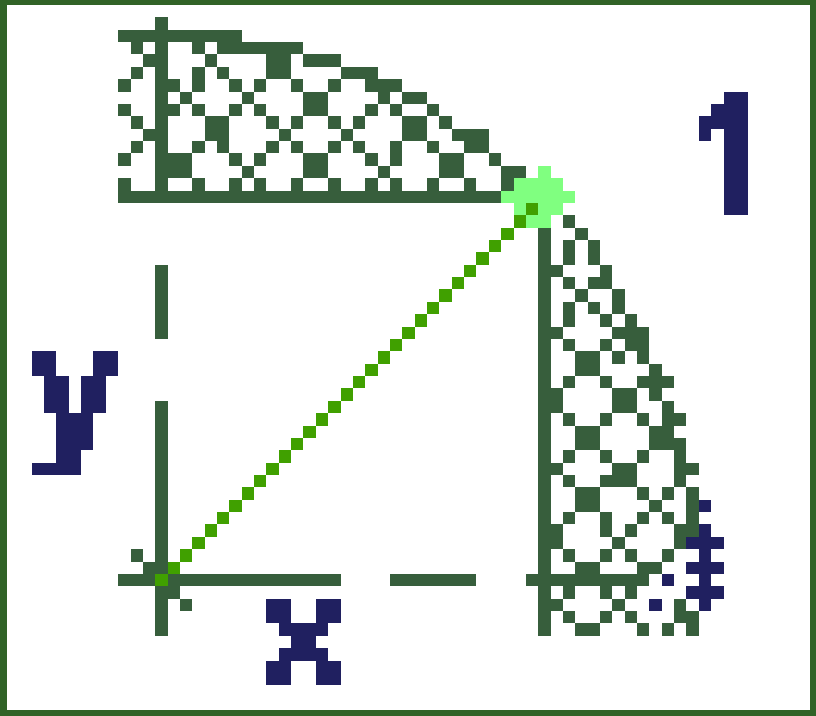
x & y absolute positive difference between the measured location & the basic dimension



Basic at 12.00mm

Actual at 12.25mm or 11.75mm

Use positive 0.25mm in calculations

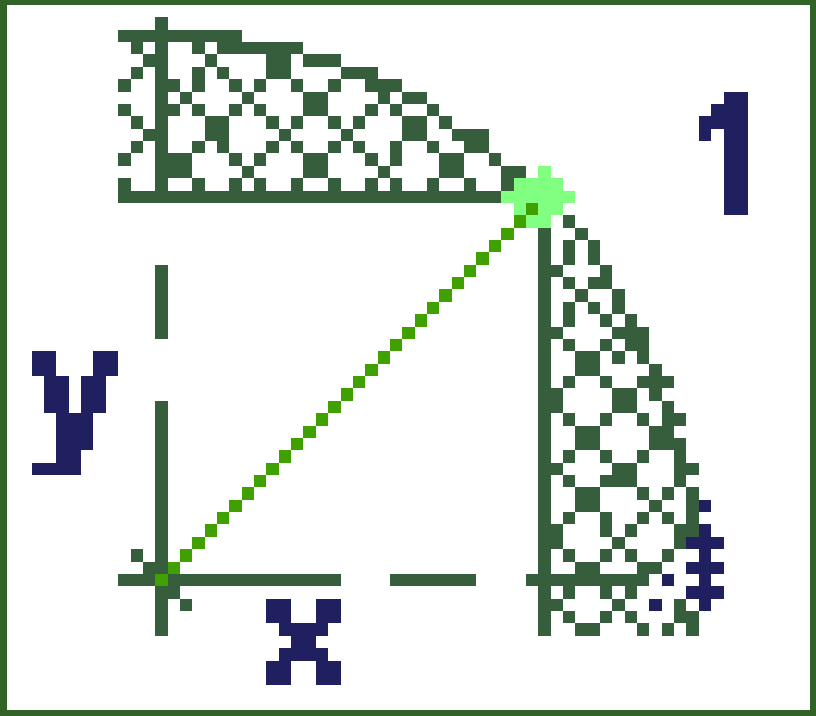


Basic 12.00 mm

Actual location x 12.25mm

y 12.25mm

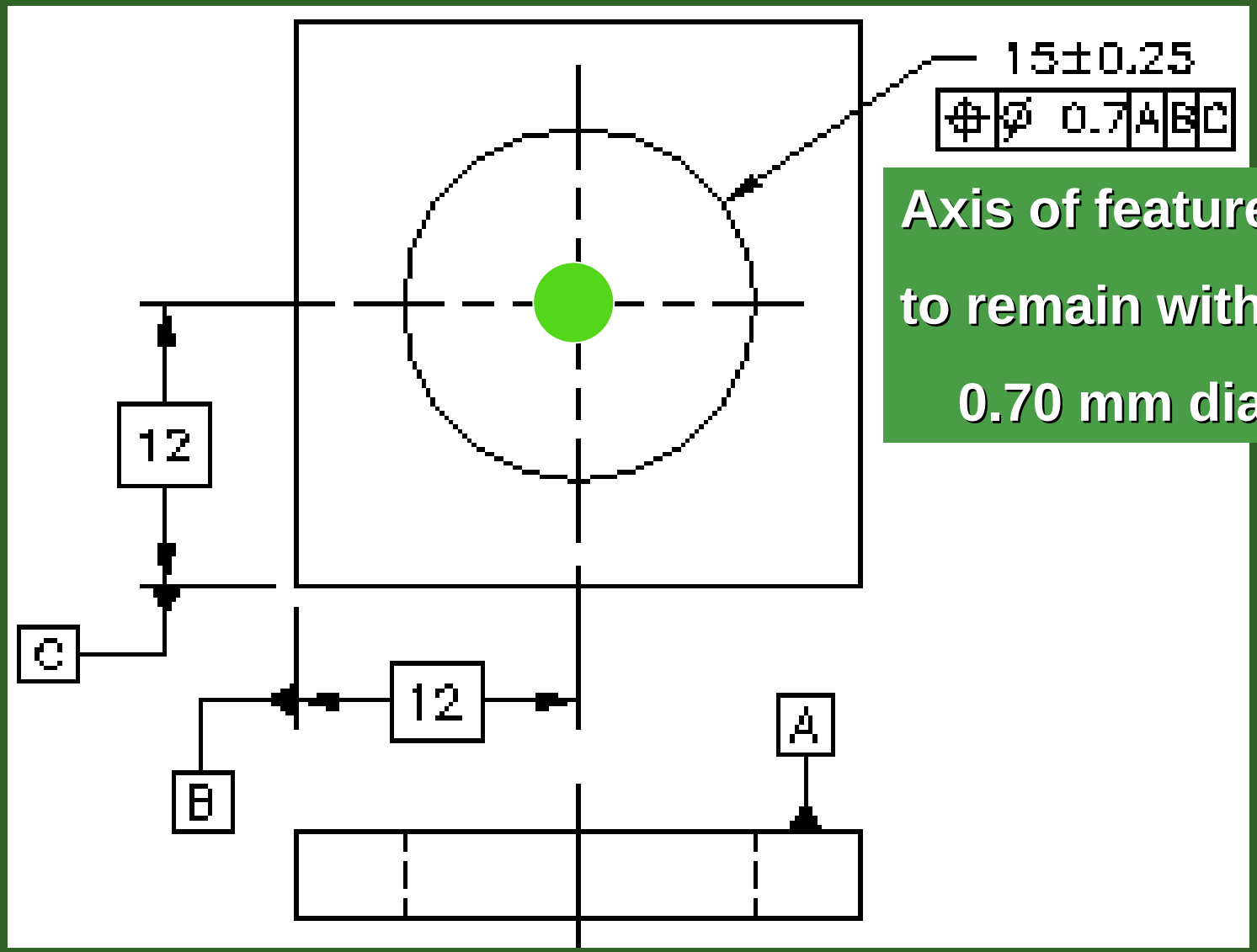
Formula $2\sqrt{.25^2 + .25^2} = .7$



Report Calculated Diameter to Specified Tolerance

- in tolerance --------- equal or smaller
  - Axis of feature is at or inside zone
- out of tolerance ---- larger
  - Axis of feature is outside of zone

Positional Tolerance



Axis of feature to remain within 0.70 mm dia.

Summary
Basic Dimensions

- Locate Tolerance Zones
- Theoretically Perfect
- Have No Tolerance

Summary Tolerance Zones

- Conventional
  - Square shape
- Positional
  - Round shape
  - 57% more area

Summary
Tolerance Calculations

- Use absolute, positive difference
- Basic Dimension at 12.00mm
- Actual at 12.25mm or 11.75mm
- Use positive 0.25mm in calculations